

TRANSMITTAL LETTER OF THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		Attorney Docket No. <b>2001-1017</b>
		U.S. Application No. <b>10/049854</b>
INTERNATIONAL APPLN. NO. <b>PCT/NL00/00574</b>	INTERNATIONAL FILING DATE <b>17 AUGUST 2000</b>	PRIORITY DATE CLAIMED <b>19 AUGUST 1999</b>
TITLE OF INVENTION: <b>GREENHOUSE AS WELL AS ROOF ELEMENT FOR SUCH A GREENHOUSE HAVING INCREASED LIGHT TRANSMISSION</b>		
APPLICANT(S) FOR DE/EO/US: <b>JOHANNES ANDREAS STOFFERS AND PIETER JAN SONNEVELD</b>		
Applicant herewith submits to the United States Designated Elected Office (DO/EO/US) the following items and other information:		
<ol style="list-style-type: none"> <li>1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.</li> <li>2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.</li> <li>3. <input checked="" type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.</li> <li>4. <input checked="" type="checkbox"/> The US has been elected by the expiration of 19 months from the priority date (Article 31).</li> <li>5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371 (c)(2)) <ol style="list-style-type: none"> <li>a. <input checked="" type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau)</li> <li>b. <input type="checkbox"/> has been communicated by the International Bureau. See attached PCT/IB/308.</li> <li>c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).</li> </ol> </li> <li>6. <input type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371 (c)(2)) <ol style="list-style-type: none"> <li>a. <input type="checkbox"/> is attached hereto.</li> <li>b. <input type="checkbox"/> has been previously submitted under 35 U.S.C. 154(d)(4).</li> </ol> </li> <li>7. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3)) <ol style="list-style-type: none"> <li>a. <input type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau).</li> <li>b. <input type="checkbox"/> have been communicated by the International Bureau.</li> <li>c. <input type="checkbox"/> have not been made, however, the time limit for making such amendments has NOT expired.</li> <li>d. <input type="checkbox"/> have not been made and will not be made.</li> </ol> </li> <li>8. <input type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).</li> <li>9. <input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).</li> <li>10. <input type="checkbox"/> An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).</li> </ol> <p><b>Items 11 to 20 below concern document(s) or information included:</b></p> <ol style="list-style-type: none"> <li>11. <input checked="" type="checkbox"/> Information Disclosure Statement (IDS) w/PTO-1449 - <input checked="" type="checkbox"/> Copy of IDS citations</li> <li>12. <input type="checkbox"/> Assignment Papers (cover sheet &amp; document(s))</li> <li>13. <input checked="" type="checkbox"/> A FIRST Preliminary Amendment.</li> <li>14. <input type="checkbox"/> A SECOND or SUBSEQUENT Preliminary Amendment.</li> <li>15. <input type="checkbox"/> A substitute specification.</li> <li>16. <input type="checkbox"/> A change of power of attorney and/or address letter.</li> <li>17. <input type="checkbox"/> A computer-readable form of the sequence listing in accordance with PCT Rule</li> <li>18. <input type="checkbox"/> A second copy of the published international application under 35 U.S.C. 154(d)(4).</li> <li>19. <input type="checkbox"/> A second copy of the English language translation of the international application (35 U.S.C. 154(d)(4)).</li> <li>20. <input checked="" type="checkbox"/> Other items or information: International Preliminary Examination Report (PCT/IPEA/409), International Search Report (PCT/ISA/210), Abstract on a separate sheet, Application Data Sheet</li> </ol>		


U.S. APPLICATION NO. <b>10/049854</b>		INTERNATIONAL APPLN. NO. PCT/NL00/00574		ATTORNEY DOCKET NO. 2001-1017																																																							
21. <input checked="" type="checkbox"/> The following fees are submitted:  BASIC NATIONAL FEE (37 CFR 1.492 (a) (1)-(5):  Neither international preliminary examination fee nor international search fee paid to USPTO and international Search Report not prepared by the EPO or JPO .....\$1040.00  International preliminary examination fee not paid to USPTO but International Search Report prepared by the EPO or JPO .....\$890.00  International preliminary examination fee not paid to USPTO but International search fee paid to USPTO .....\$740.00  International preliminary examination fee paid to USPTO but all claims did not satisfy provision of PCT Article 33 (1)-(4).....\$710.00  International preliminary examination fee paid to USPTO and all claims satisfied provision of PCT Article 33 (1)-(4).....\$100.00  <b>ENTER APPROPRIATE BASIC FEE AMOUNT</b>  Surcharge of \$130.00 for furnishing the oath or declaration than <input type="checkbox"/> 20- <input checked="" type="checkbox"/> 30 Months from the earliest claimed priority date (37 CFR 1.492(e)) <table border="1"><thead><tr><th>CLAIMS</th><th>NUMBER FILED</th><th>NUMBER EXTRA</th><th>RATE</th></tr></thead><tbody><tr><td>Total Claims</td><td>13 - 20 =</td><td>0</td><td>X \$18.00</td></tr><tr><td>Independent Claims</td><td>2 - 3 =</td><td>0</td><td>X \$84.00</td></tr><tr><td colspan="3">MULTIPLE DEPEND CLAIM(S) (if applicable)</td><td>+ \$280.00</td></tr><tr><td colspan="3"><b>TOTAL OF ABOVE CALCULATION -</b></td><td><b>\$ 1,020.00</b></td></tr><tr><td colspan="3"><input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.</td><td>+</td></tr><tr><td colspan="3"><b>SUBTOTAL =</b></td><td><b>\$ 1,020.00</b></td></tr><tr><td colspan="3">Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492Z(f)).</td><td>\$</td></tr><tr><td colspan="3"><b>TOTAL NATIONAL FEE =</b></td><td><b>\$ 1,020.00</b></td></tr><tr><td colspan="3">Fee for recording the enclosed assigned (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) \$40.00 per property +</td><td>\$</td></tr><tr><td colspan="3"><b>TOTAL FEES ENCLOSED -</b></td><td><b>\$ 1,020.00</b></td></tr><tr><td colspan="3"></td><td>Amount to be refunded:</td><td>\$</td></tr><tr><td colspan="3"></td><td>Charged:</td><td>\$</td></tr></tbody></table>				CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	Total Claims	13 - 20 =	0	X \$18.00	Independent Claims	2 - 3 =	0	X \$84.00	MULTIPLE DEPEND CLAIM(S) (if applicable)			+ \$280.00	<b>TOTAL OF ABOVE CALCULATION -</b>			<b>\$ 1,020.00</b>	<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.			+	<b>SUBTOTAL =</b>			<b>\$ 1,020.00</b>	Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492Z(f)).			\$	<b>TOTAL NATIONAL FEE =</b>			<b>\$ 1,020.00</b>	Fee for recording the enclosed assigned (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) \$40.00 per property +			\$	<b>TOTAL FEES ENCLOSED -</b>			<b>\$ 1,020.00</b>				Amount to be refunded:	\$				Charged:	\$	CALCULATIONS PTO USE ONLY	
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☒ A Check in the amount of **\$1,020.00** to cover all fees is attached.

☐ The Commissioner is hereby authorized to charge indicated fees and credit any overpayments to Deposit account No. 25-0120 in the name of Young & Thompson, as described below. A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fee required under 37 C.F.R. §§ 1.16 or 1.17.

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REGISTRATION NO. 35,041

BC/lmt  
Date: **February 19, 2002**

PATENT  
2001-1017

IN THE U.S. PATENT AND TRADEMARK OFFICE

In re application of: Johannes Andreas STOFFERS et al.

Appl. No.: NEW Group:  
Filed: February 19, 2002 Examiner:  
For: GREENHOUSE AS WELL AS ROOF ELEMENT  
FOR SUCH A GREENHOUSE HAVING INCREASED  
LIGHT TRANSMISSION

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents February 19, 2002  
Washington, DC 20231

Sir:

The following preliminary amendments and remarks are respectfully submitted in connection with the above-identified application.

IN THE ABSTRACT OF THE DISCLOSURE:

Please add the Abstract of the Disclosure attached on a separate sheet attached hereto.

IN THE CLAIMS:

Please amend the claims as follows:

--4. (amended) Greenhouse (1, 28) according to claim 1, characterised in that the roof surfaces (52, 53, 54, 55) are of doubled-wall construction, having a base sheet (51, 73, 74) and

transverse links (58, 59, 75, 76, 77) between the points of the apexes and/or the base edges (60, 61, 62, 63, 78, 79) of the roof surfaces and the base sheet.--

--5. (amended) Greenhouse (1, 28) according to Claim 3, characterised in that a distance ( $d_2$ ,  $d_3$ ,  $d_4$ ) between the base edges (18, 19, 20, 21, 78, 79) of the pairs of second roof surfaces (12, 13, 14, 15, 71, 72) is between 0.5 and 0.001 times the distance ( $d_1$ ) between the base edges (11, 11', 11'') of the pairs of first roof surfaces (5, 6, 7, 8).--

--6. (amended) Greenhouse (1, 28) according to Claim 3, characterized in that a perpendicular distance ( $h_2$ ,  $h_3$ ) between the edge at the apex (16, 17, 27, 28) and the base edges (18, 19, 20, 21, 60, 61, 62, 63) of the pairs of second roof surfaces is between 0.5 and 0.001 times the perpendicular distance between the edge at the apex (9, 10) and the base edges (11, 11', 11'') of the pairs of the first roof surfaces (5, 6, 7, 8).--

--9. (amended) Roof element (50, 80) according to Claim 7, characterized in that a distance between the base sheet (51, 81) and the apex (56, 57, 90) is between 1cm and 10cm, preferably between 1.5cm and 3cm.--

--10. (amended) Roof between (50, 80) according to Claim 7, characterized in that the distance ( $d_3$ ,  $d_4$ ) between the base edges is between 1cm and 10cm, preferably between 1.5cm and 3cm.--

--11. (amended) Roof element (50, 80) according to Claim 7, characterized in that the angle ( $\theta$ ) of the roof surfaces is between  $30^\circ$  and  $75^\circ$ , preferably between  $45^\circ$  and  $75^\circ$ .--

--12. (amended) Roof element (50, 80) according to Claim 7, characterized in that the roof element consists of one piece and is made from transparent plastic having a wall thickness of between 0.5mm and 5mm, preferably between 0.5mm and 2mm.--

--13. (amended) Roof element (76, 77) according to Claim 7, characterized in that the roof element is provided with coupling means (78, 79) for joining to a similar roof element.--

REMARKS

Claims 1-13 are pending in the present application.

Entry of the above amendments is earnestly solicited. An early and favorable first action on the merits is earnestly requested.

Should there be any matters that need to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned at the telephone number listed below.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE."

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any

overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

YOUNG & THOMPSON



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Telephone (703) 521-2297

BC/lmt  
Attachments

## ABSTRACT OF THE DISCLOSURE

Greenhouse (1) provided with a roof element (2) having a multiplicity of transverse ribs (12, 13, 14, 15) or pyramids uniformly distributed over the roof element. The roof element can be constructed double-walled as a hollow-core sheet from transparent plastic and can comprise a base sheet with the rib-shaped or pyramid-shaped roof surfaces fixed thereon. The light yield in a horticultural greenhouse can be increased by the roof elements.

VERSION WITH MARKINGS TO SHOW CHANGES MADEIN THE CLAIMS:

The claims have been amended as follows:

--4. (amended) Greenhouse (1, 28) according to ~~one of~~ the preceding claims, claim 1, characterised in that the roof surfaces (52, 53, 54, 55) are of doubled-wall construction, having a base sheet (51, 73, 74) and transverse links (58, 59, 75, 76, 77) between the points of the apexes and/or the base edges (60, 61, 62, 63, 78, 79) of the roof surfaces and the base sheet.--

--5. (amended) Greenhouse (1, 28) according to Claim 3 ~~or~~ 4, characterised in that a distance ( $d_2$ ,  $d_3$ ,  $d_4$ ) between the base edges (18, 19, 20, 21, 78, 79) of the pairs of second roof surfaces (12, 13, 14, 15, 71, 72) is between 0.5 and 0.001 times the distance ( $d_1$ ) between the base edges (11, 11', 11'') of the pairs of first roof surfaces (5, 6, 7, 8).--

--6. (amended) Greenhouse (1, 28) according to Claim 3, 4 ~~or 5~~, characterized in that a perpendicular distance ( $h_2$ ,  $h_5$ ) between the edge at the apex (16, 17, 27, 28) and the base edges (18, 19, 20, 21, 60, 61, 62, 63) of the pairs of second roof surfaces is between 0.5 and 0.001 times the perpendicular distance between the edge at the apex (9, 10) and the base edges (11, 11', 11'') of the pairs of the first roof surfaces (5, 6, 7, 8).--

--9. (amended) Roof element (50, 80) according to Claim 7 ~~or 8~~, characterized in that a distance between the base sheet



(51, 81) and the apex (56, 57, 90) is between 1cm and 10cm, preferably between 1.5cm and 3cm.--

--10. (amended) Roof between (50, 80) according to Claim 7, ~~8 or 9~~, characterized in that the distance ( $d_3$ ,  $d_4$ ) between the base edges is between 1cm and 10cm, preferably between 1.5cm and 3cm.--

--11. (amended) Roof element (50, 80) according to Claim 7, ~~8 or 9~~, characterized in that the angle ( $\theta$ ) of the roof surfaces is between  $30^\circ$  and  $75^\circ$ , preferably between  $45^\circ$  and  $75^\circ$ .--

--12. (amended) Roof element (50, 80) according to ~~one of Claims 7 to 11~~, Claim 7, characterized in that the roof element consists of one piece and is made from transparent plastic having a wall thickness of between 0.5mm and 5mm, preferably between 0.5mm and 2mm.--

--13. (amended) Roof element (76, 77) according to ~~one of Claims 7 to 12~~, Claim 7, characterized in that the roof element is provided with coupling means (78, 79) for joining to a similar roof element.--

Greenhouse as well as roof element for such a greenhouse having increased light transmission

The invention relates to a greenhouse having a transparent roof construction with a longitudinal direction and a transverse direction located perpendicularly thereto, having various pairs of first roof surfaces in succession in the transverse direction, the first roof surfaces of a predetermined pair running at an angle with respect to a horizontal from a base edge oriented in the longitudinal direction of the greenhouse to a common apex. The invention also relates to a roof element for use in such a greenhouse.

It is known from the publication entitled "Second International Symposium on Models for Plant Growth", Environmental Control and Farm Management in Protected Cultivation, number 456, March 1998, to provide horticultural greenhouses with roof surfaces in succession in the transverse direction which run in the shape of a point towards an apex. For angles to the horizontal of greater than 45° the light transmission for radiation which is incident perpendicularly on the greenhouse is found to increase substantially. This is particularly important in horticultural greenhouses since one per cent more light yield results in approximately one per cent more yield of crops.

An aim of the present invention is to provide a roof construction of the above-mentioned type, provided with a quantity of pairs of roof surfaces which are laid in contact with one another and come together in an apex, the light transmission being increased.

To this end the roof construction according to the present invention is characterised in that the greenhouse is also provided with pairs of successive second roof surfaces in the longitudinal direction, which second roof surfaces run at an angle with respect to the horizontal from a base edge oriented in the transverse direction of the greenhouse to a common apex.

It has been found that a zigzag or ribbed pattern of the roof surfaces extending in two perpendicular directions is able to increase the light yield by 10%-20% compared with roof constructions which are of zigzag construction only in the transverse direction. In a first embodiment the pairs of roof surfaces form pyramids which are joined to one another along their sides to give a continuous roof construction.

In another embodiment of a greenhouse according to the invention the pairs of first roof surfaces are in contact with one another along edges at the apex, wherein base edges and the edges at the apex of the pairs of first roof surfaces extend parallel to one another in

the longitudinal direction, wherein the pairs of second roof surfaces are in contact with one another along edges at the apex and wherein the base edges and the edges at the apex of the second pairs of roof surfaces extend parallel to one another from a base edge of a first roof surface to the edge at the apex of the first roof surface concerned. By this means successive transverse ribs are formed in the longitudinal direction of the greenhouse.

It is preferable to construct roof elements with a zigzag pattern double-walled as a hollow-core sheet so that, on the one hand, adequate strength and insulating effect of the roof construction is obtained whilst, on the other hand, the light transmission is increased. The double-walled roof elements comprise a base surface made of, for example, polycarbonate with a thickness of 0.8 mm on which a zigzag-shaped sheet with ribs approximately 20 mm high is fixed. Preferably, the double-walled roof element is made in one piece. The roof elements can be of modular construction and are provided with coupling means for joining to similar roof elements.

A greenhouse according to the present invention and a roof element will be explained in more detail below with reference to the appended drawing. In the drawing:

Figure 1 shows a diagrammatic, perspective view of a roof with a roof construction that is in zigzag form in the transverse direction and the longitudinal direction,

Figure 2 shows a diagrammatic, perspective view of a roof construction formed from a series of pyramids,

Figure 3 shows a cross-section of a double-walled roof element in the form of a hollow-core sheet according to the present invention,

Figure 4 shows an alternative embodiment of a double-walled roof element in the form of a hollow-core sheet according to the invention,

Figure 5 shows a double-walled roof element formed by a series of pyramids, and

Figure 6 shows two roof elements joined to one another by means of coupling means.

Figure 1 shows a greenhouse 1, such as, for example, a greenhouse of the Venlo type having a transparent roof construction 2. The roof construction 2 is supported on uprights 3 and horizontal lattice girders 4, which are shown here diagrammatically only. The height  $h_1$  of a greenhouse as shown in Figure 1 is, for example, 4 m, whilst the width,  $d_1$  in the transverse direction  $D$ , is 8 m for a length in the longitudinal direction  $L$  of, for example, 100 m. The roof construction 2 comprises pairs of first roof surfaces 5, 6; 7, 8, which run from a base edge 11, 11', 11'' at an angle  $\theta$  of approximately  $20^\circ$  with respect to the horizontal and which are fixed to one another along a respective apex 9, 10. The height  $h_1$

of the apex 9, 10 above the lattice girder 4 is, for example, 1.45 m. In the longitudinal direction L the pairs of roof surfaces 5, 6; 7, 8 are provided with transverse ribs, formed by pairs of second roof surfaces 12, 13; 14, 15. The roof surfaces 12, 13; 14, 15 run at an angle  $\gamma$  from base edges 18, 19; 20, 21 and are joined to one another along edges at the apex 16, 17. The distance  $d_2$  between the base edges 18, 19; 20, 21 of the pairs of second roof surfaces 12, 13; 14, 15 is, for example, 2 cm, whilst the height  $h_2$  of the edge at the apex 16, 17 above the plane of the base edges 18, 19; 20, 21 is 1.7 cm. As a result of fitting the pairs of zigzag-shaped second roof surfaces 12, 13; 14, 15 the light yield is increased by approximately 10% for a single layer roof construction and by approximately 20% for a double layer roof construction as is shown in Figure 3 and Figure 4, compared with known greenhouses where only pairs of first roof surfaces 5, 6; 7, 8 are present.

Figure 2 shows an embodiment of a greenhouse 28 having a roof construction 29 in which the base edges 30, 31, 32, 33 of pairs of first roof surfaces 34, 35 and pairs of second roof surfaces 36, 37 delimit rectangles in contact with one another, above which the roof surfaces 34, 35; 36, 37 come together in an apex 38, so that a multiplicity of pyramids 39, 40 is formed to increase the light yield. Here the length of the base edges 31, 32 is approximately 1 m, whilst the height of the pyramids is 1.7 m.

Figure 3 shows an embodiment of a double-walled roof element 50 in the form of a hollow-core sheet having a base sheet 51 and pairs of roof surfaces 52, 53, 54, 55 which are joined to one another along edges at the apex 56, 57 extending perpendicularly to the plane of the drawing. The base edges 60, 61, 62, 63 are joined via partitions 58, 59 to the base sheet 1. The thickness  $b_1$  of the base sheet is, for example, 0.8 mm, the thickness  $b_2$  of the surfaces 52, 53, 54, 55 is, for example, 1 mm, the height  $h_3$  is, for example, 28 mm, whilst the distance  $d_3$  between the base edges 60, 61, 62, 63 is, for example, 16 mm. The height  $h_5$  is 13.9 mm.

The angle  $\theta$  of the roof surfaces 52, 53, 54, 55 to the horizontal is  $60^\circ$ . The material of the double-walled roof element 50 is, for example, polycarbonate, but this element can also be made from any other suitable transparent plastic.

Figure 4 shows an alternative embodiment of a double-walled roof element 70 having roof surfaces 71, 72, which are positioned at an angle, and base surfaces 73, 74, which are likewise positioned at an angle and which are joined to one another by partitions 75, 76, 77. The thickness  $b_3$  of the roof surfaces 71, 72 is, for example, 1 mm, the distance  $h_4$  between the roof surfaces 71, 72 and the base surfaces 73, 74 is, for example, 20 mm and

the thickness  $b_4$  of the partition 77 is, for example, 0.8 mm. The distance  $d_4$  between the base edges 78, 79 is, for example, 30 mm.

Figure 5 shows an embodiment of a roof element 80 made from one piece of transparent plastic and having a base sheet 81. Four surfaces 82, 83, 84, 85 extend along  
5 four base edges 86, 87, 88, 89 of the base sheet 81 to a common apex 90. In this way a multiplicity of pyramids uniformly distributed over the base sheet 81 are formed. Here the length of the base edges 86, 87, 88, 89 is, for example, 1.5 m and the distance from the apex 90 to the base sheet 81 is 2.6 m.

Finally, Figure 6 shows two roof elements 90, 91 which are joined to one another via  
10 complementary fixing means 92, 93 which engage in a simple manner and in modular fashion form a roof construction according to the present invention.

## Claims

1. Greenhouse (1,28) comprising a transparent roof construction (2,29) with a longitudinal direction (L) and a transverse direction (D) located perpendicularly thereto, having various pairs of first roof surfaces (5,6,7,8,36,37) in succession in the transverse direction (D), the first roof surfaces of a predetermined pair running at an angle ( $\theta$ ) with respect to a horizontal from a base edge (11,11',11'',30,33) oriented in the longitudinal direction (L) of the greenhouse to a common apex (9,10,38), characterised in that the greenhouse is provided with pairs of successive second roof surfaces (12,13,14,15;34,35) in the longitudinal direction (L), which second roof surfaces extend at an angle ( $\gamma$ ) with respect to the horizontal from a base edge (18,19,20,21;31,32) oriented in the transverse direction (D) of the greenhouse to a common apex (16,17,38).

2. Greenhouse (28) according to Claim 1, characterised in that four mutually adjoining perpendicular base edges (30,31,32,33) each time delimit a rectangle, wherein the rectangles extend successively in the longitudinal direction (L) and the transverse direction (D) of the roof construction and wherein, for each rectangle, first and second pairs of roof surfaces (34,35,36,37) extend from the base edges (30,31,32,33) to a common apex (38) located above the rectangle concerned.

3. Greenhouse (1) according to Claim 1, characterised in that the pairs of first roof surfaces (5,6,7,8) are in contact with one another along edges at the apex (9,10), wherein the base edges (11,11',11'') and the edges at the apex (9,10) of the pairs of first roof surfaces (5,6,7,8) extend parallel to one another in the longitudinal direction (L), wherein the pairs of second roof surfaces (12,13,14,15) are in contact with one another along edges at the apex (16,17) and wherein the base edges (18,19,20,21) and the edges at the apex (16,17) of the second pairs of roof surfaces (12,13,14,15) extend parallel to one another from a base edge (11,11',11'') of a first roof surface (5,6,7,8) to the edge at the apex (9,10) of the first roof surface concerned.

4. Greenhouse (1,28) according to one of the preceding claims, characterised in that the roof surfaces (52,53,54,55) are of double-walled construction, having a base sheet (51,73,74) and transverse links (58,59,75,76,77) between the points of the apexes and/or

the base edges (60,61,62,63,78,79) of the roof surfaces and the base sheet.

5 5. Greenhouse (1,28) according to Claim 3 or 4, characterised in that a distance ( $d_2, d_3, d_4$ ) between the base edges (18,19,20,21,78,79) of the pairs of second roof surfaces (12,13,14,15,71,72) is between 0.5 and 0.001 times the distance ( $d_1$ ) between the base edges (11,11',11'') of the pairs of first roof surfaces (5,6,7,8).

10 6. Greenhouse (1,28) according to Claim 3, 4 or 5, characterised in that a perpendicular distance ( $h_2, h_3$ ) between the edge at the apex (16,17,27,28) and the base edges (18,19,20,21,60,61,62,63) of the pairs of second roof surfaces is between 0.5 and 0.001 times the perpendicular distance between the edge at the apex (9,10) and the base edges (11,11',11'') of the pairs of first roof surfaces (5,6,7,8).

15 7. Roof element (50,80) for use in a greenhouse, provided with various pairs of roof surfaces (52,53,54,55,82,83) in succession in a transverse direction (D) and a base sheet (51,81), wherein the roof surfaces of a predetermined pair run at an angle ( $\theta$ ) with respect to the base sheet from a base edge (60,61,62,63,86,88) oriented in a longitudinal direction (L) to a common apex (56,57,90), which roof surfaces (52,53,54, 55,82,83) are joined to the base sheet along the base edges and/or at the location of the apex.

20 8. Roof element (80) according to Claim 7, characterised in that the roof element is furthermore provided with pairs of second roof surfaces (84,85) in succession in a longitudinal direction (L) which run at an angle with respect to the base sheet (81) from a base edge (87,89) oriented in a transverse direction (D) to a common apex (90), wherein  
25 four base edges (86,87,88,89) perpendicular to one another always delimit a rectangle, wherein the rectangles extend successively in the longitudinal direction (L) and the transverse direction (D) of the base sheet (81) and wherein, for each rectangle, first and second pairs of roof surfaces (82,83,84,85) extend from the base edges (86,87,88,89) to a common apex (90) located above the rectangle concerned.

30

9. Roof element (50,80) according to Claim 7 or 8, characterised in that a distance between the base sheet (51,81) and the apex (56,57,90) is between 1 cm and 10 cm, preferably between 1.5 cm and 3 cm.

10. Roof element (50,80) according to Claim 7, 8 or 9, characterised in that the distance ( $d_3, d_4$ ) between the base edges is between 1 cm and 10 cm, preferably between 1.5 cm and 3 cm.

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11. Roof element (50,80) according to Claim 7, 8 or 9, characterised in that the angle ( $\theta$ ) of the roof surfaces is between  $30^\circ$  and  $75^\circ$ , preferably between  $45^\circ$  and  $75^\circ$ .

12. Roof element (50,80) according to one of Claims 7 to 11, characterised in that the  
10 roof element consists of one piece and is made from transparent plastic having a wall thickness of between 0.5 mm and 5 mm, preferably between 0.5 mm and 2 mm.

13. Roof element (76,77) according to one of Claims 7 to 12, characterised in that the roof element is provided with coupling means (78,79) for joining to a similar roof element.



**(19) World Intellectual Property Organization  
International Bureau**



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 1040 1

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**1 March 2001 (01.03.2001)**

**(10) International Publication Number**  
**WO 01/13704 A1**

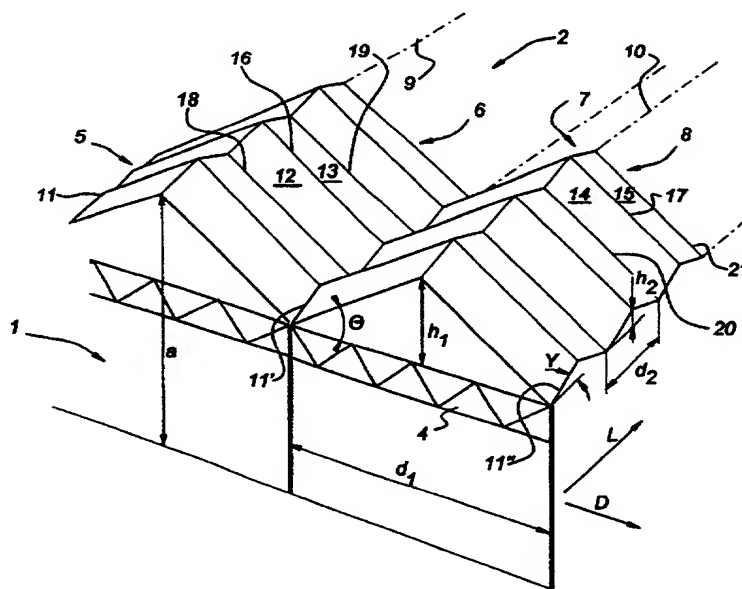
**PCT**

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1012866 19 August 1999 (19.08.1999) NL
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- (81) **Designated States (national)**: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
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— *With international search report.*

*[Continued on next page]*

**(54) Title: GREENHOUSE AS WELL AS ROOF ELEMENT FOR SUCH A GREENHOUSE HAVING INCREASED LIGHT TRANSMISSION**



**(57) Abstract:** The invention relates to a greenhouse (1) provided with a roof element (2) having a multiplicity of transverse ribs (12, 13, 14, 15) or pyramids uniformly distributed over the roof element. The roof element can be constructed double-walled as a hollow-core sheet from transparent plastic and can comprise a base sheet with the rib-shaped or pyramid-shaped roof surfaces fixed thereon. The light yield in a horticultural greenhouse can be increased by means of the roof elements according to the present invention.

**WO 01/13704 A1**

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Fig 1

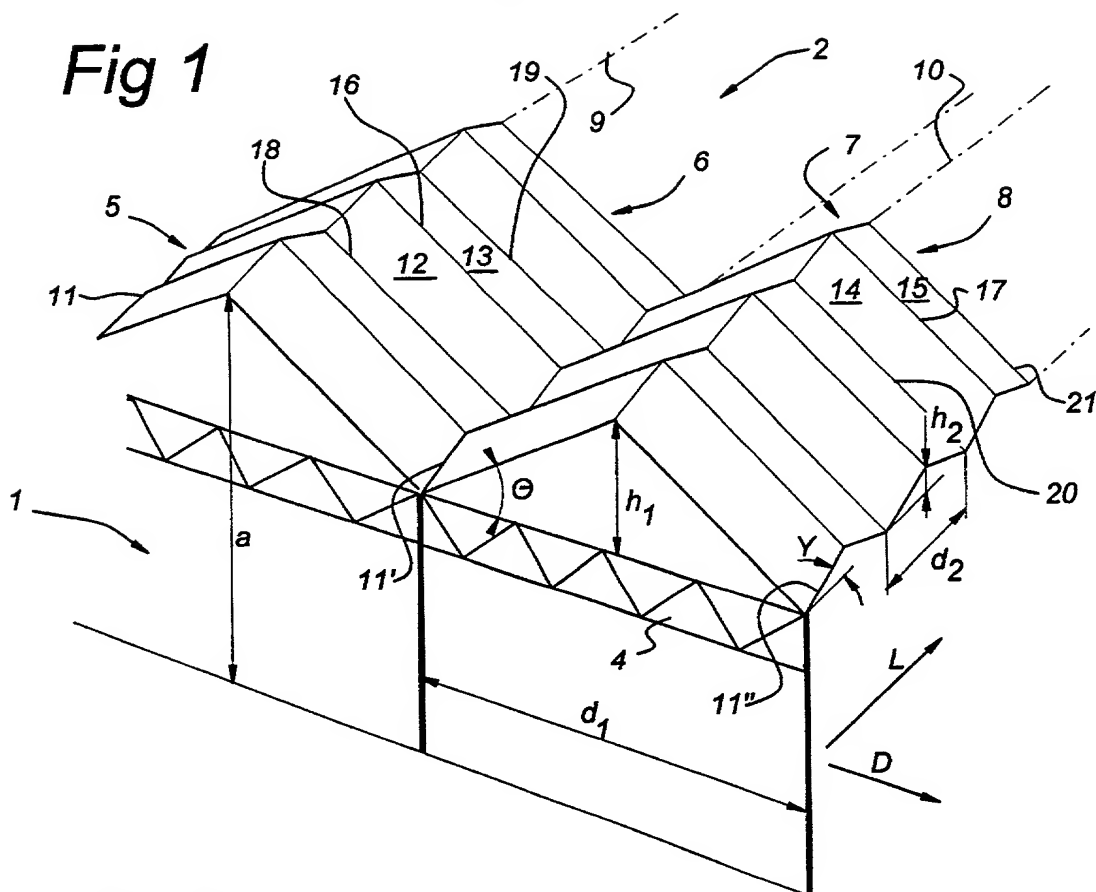


Fig 2

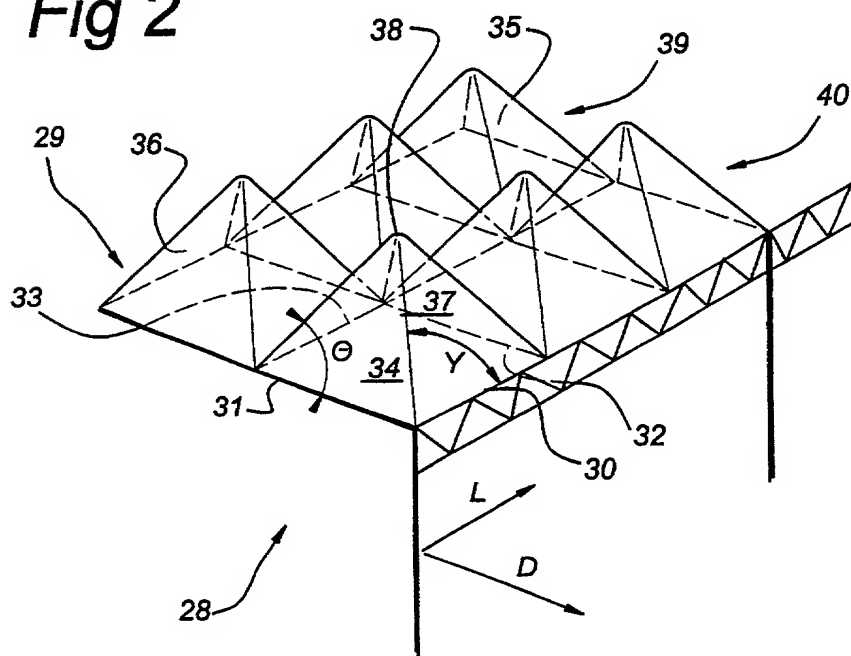


Fig 3

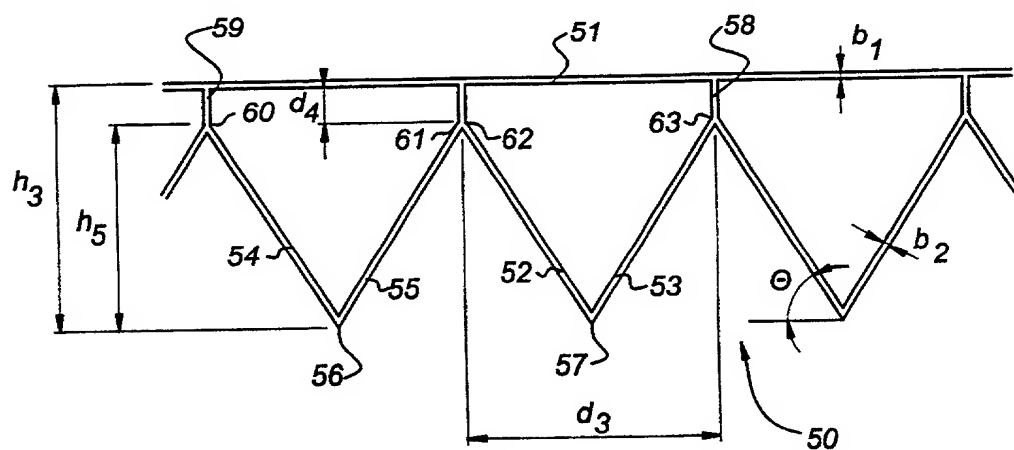
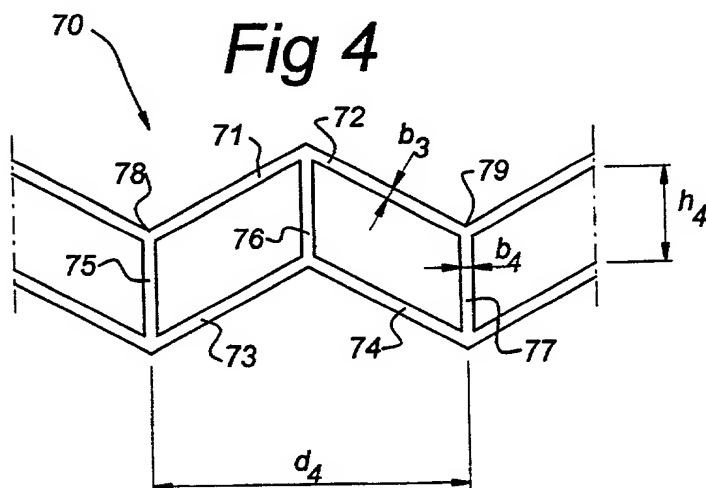


Fig 4



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Fig 5

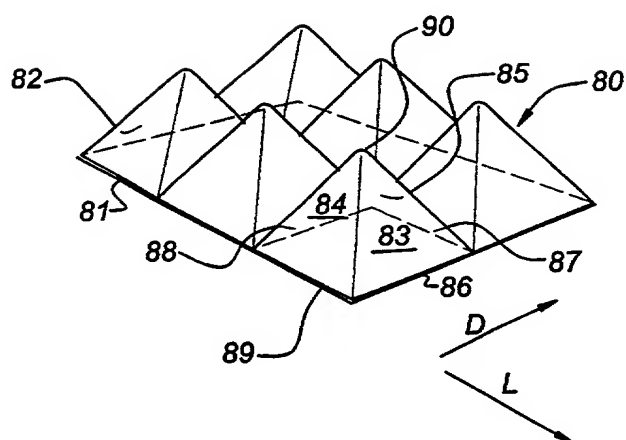
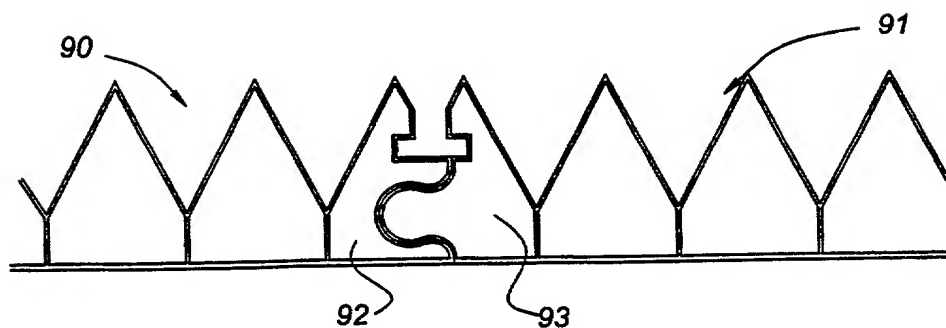


Fig 6



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# COMBINED DECLARATION AND POWER OF ATTORNEY

(ORIGINAL DESIGN, NATIONAL STAGE OF PCT OR CIP APPLICATION)

As a below named inventor, I hereby declare that

My residence, post office address and citizenship are as stated below next to my name, I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**Greenhouse as well as roof element for such a greenhouse having increased light transmission**

the specification of which: (complete (a), (b) or (c) for type of application)

## REGULAR OR DESIGN APPLICATION

- a. ☐ is attached hereto.  
b. ☐ was filed on \_\_\_\_\_ as Application  
Serial No. \_\_\_\_\_ and was amended on \_\_\_\_\_  
(if applicable)

## PCT FILED APPLICATION ENTERING NATIONAL STAGE

- c. ☒ was described and claimed in International application No. PCT/NL00/00574  
filed on 17 August 2000  
and as amended on \_\_\_\_\_ (if any)

## ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, paragraph 1.56(a).

In compliance with this duty there is attached an information disclosure statement 37 CFR 1.97

## PRIORITY CLAIM

I hereby claim foreign priority benefits under Title 35, United States Code paragraph 119 of any foreign application (s) for patent of inventor's certificate listed below and have also identified below any foreign application for patent of inventor's certificate having a filing date before that of the application on which priority is claimed.

(complete (d) or (e))

- d. ☐ no such applications have been filed  
e. ☒ such applications have been filed as follows

**EARLIEST FOREIGN APPLICATION(S), IF ANY FILED WITHIN 12 MONTHS  
(6 MONTHS FOR DESIGN) PRIOR TO SAID APPLICATION**

Country	Application Number	Date of filing (day, month, year)	Date of Issue (day, month, year)	Priority claimed
the Netherlands	1012866	19 August 1999		Yes

**ALL FOREIGN APPLICATION(S), IF ANY FILED MORE THAN 12 MONTHS  
(6 MONTHS FOR DESIGN) PRIOR TO SAID APPLICATION**

\_\_\_\_\_

\_\_\_\_\_

**CONTINUATION-IN-PART**

(Complete this part only if this is a continuation-in-part application)

I hereby declare claim the benefit under Title 35, United States code, paragraph 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claim of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, paragraph 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, paragraph 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

\_\_\_\_\_  
(Application Serial No.) (Filing date) (Status) (patented, pending, abandoned)

\_\_\_\_\_  
(Application Serial No.) (Filing date) (Status) (patented, pending, abandoned)

**POWER OF ATTORNEY**

As a named inventor, I hereby appoint the following attorney(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: Robert J. PATCH, Reg. No. 17,355, Andrew J. PATCH, Reg. No. 32,925, Robert F. HARGEST, Reg. No. 25,590, Benoît CASTEL, Reg. No. 35,041, Eric Jensen, Reg. No. 37,855, and Thomas W. PERKINS, Reg. No. 33,027 and Roland E. Long, Jr. Reg. No. 41,949 c/o YOUNG & THOMPSON, Second Floor, 745 South 23rd Street, Arlington, Virginia 22202.

Address all telephone calls to Young & Thompson at 703/521-2297.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment, or both under Section 1001 of Title 18 of the United States Code and that such wilful false statements may jeopardize the validity of the application or any patent issued thereon.

1-00  
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